On the Comparative Prevalence of Filth-Diseases in Town and Country. By James B. Russell, M.D., Medical Officer of Health, Glasgow.

[Read before the Philosophical Society of Glasgow, December 19, 1877.]

Mr. President and Gentlemen,—My first duty is to thank the members of the Sanitary Section of the Philosophical Society for making me their President, and so enabling me, from the elevation of that position, to address the parent Society to-night. Sanitary Science is not one which progresses by its principles or basement facts being the property of a few. The intelligence of the majority will always mark the farthest limit of sanitary advancement. Every opportunity, therefore, afforded to a man in the official position which I have the honour to occupy, of imparting information to the general public, should be welcomed. Therefore, apart from the personal honour, I value my elevation to the presidency for its useful opportunity.

The thought has probably occurred to many of you—how little do we know of the contemporary prevailing diseases and general health of Scotland at large. There are eight little areas within which all is made luminous from week to week by the Registrar-General's returns, and in some cases by the reports of local officials, but outside, over the general surface of the country, all is darkness. Unless when an epidemic in the country discloses itself by sending some sparks into the midst of a large town, or when a local correspondent is sufficiently independent of local influences to let the truth out in a city newspaper, the mass of the public have no opportunity of ever knowing what is going on. Even officials like myself, whose business it is to have such knowledge, must wait for three or four years until the Annual Detailed Report of the

Registrar-General appears, when we can only make the same use of the facts as we can of the plagues of the Middle Ages—hold them up as a warning to future generations.

I wish to-night to give you some information about extra-urban Scotland. There are some diseases whose gravity is not to be measured by the number of persons they kill in comparison with many other diseases, but by the sanitary and social meaning of their prevalence. They are indicative, it may be, of social demoralisation, or of general sanitary slovenliness and neglect, and are often the single exactly measurable item of a widespread injury to health and loss of life. For this reason I have chosen a class of diseases which are a delicate index of the cleanliness of a community, though they are not a measure of *all* the evils flowing out of uncleanliness; and I propose by them to test the comparative success of town and country in getting rid of their excreta without the production of disease. A word is necessary on the selection of our test diseases.

The condition of health of a community is the ultimate outcome of a vast number of circumstances acting and reacting upon one another, co-operating with or neutralising one another. It is vain therefore to seek, by selecting one circumstance, and by setting against it the total result of all, to establish a relative variation and probable causal connection. A physical condition such as that of density of population, covers such a range of effects upon the prime elements of health, to which it gives short and convenient expression, that we can safely conclude as to the causal connection between it and health; but we can only do so intelligently when we by analysis isolate those effects. Other physical agents, such as chemical vapours in large towns, so coincide in their line of action with other factors of disease, that it is impossible to prove their deleterious influence, and equally impossible to prove that they have no such influence. But the relation between some diseases and their causes is so precise and well ascertained, that the existence of the cause may be detected by the presence of the disease; and this is the case with the specific filth-diseases. Not that the uncleanness associated with them produces no other injury to health than those diseases. It co-operates with the general array of causes which make an unhealthy community, but the effects to which we refer are of such a nature that without fæces in some form there could be no such effects! Although alvine excretion were absolutely abolished in a community, there might still be typhus fever, scarlet fever, measles, hooping-cough, but there could not be enteric fever

or cholera, and probably not diphtheria. Whatever influence the mismanagement of this form of filth may have upon the propagation of those diseases, with the origination of which it has nothing to do, is so immaterial and insignificant in relation to the great predominant laws of their propagation, as practically to be incapable of separate estimation. But with the propagation as with the origination of such diseases as enteric fever, diphtheria, and cholera, the position is exactly reversed—the fæcal arrangements are everything. The correctness of this position being granted, it follows that it is not by appealing to the statistics of zymotic disease in the mass that we can arrive at accurate conclusions as to the merits of the fæcal arrangements of communities, not as they might be, or ought to be, but as they are.

I select diphtheria and enteric fever as the two purely fæcal diseases which are most widely distributed over this country. Diarrhœa is also in many cases the result of fæcal contamination of water and air, but it is so largely also a result of certain dietetic errors in the upbringing of infants, especially in large towns, that the statistics of its prevalence cannot safely be applied to the purpose in hand without laborious collateral check-inquiries. Indeed, my observations lead me to this general conclusion as to the meaning of a diarrhœal death-rate—that if *infantile* chiefly, as it is in all manufacturing communities, it points to serious social evils—evils which pervade the home—the prevalence of illegitimacy, or causes such as female labour, or the domestic disorganisation of drunkenness, which practically place even the legitimate child in the same circumstances as the illegitimate. I found, on an analysis of the deaths under one year in Glasgow, during a period of six months, that 63 per cent. of the legitimate were suckled, and only 14 per cent. of the illegitimate; but still more important was the discovery that of the *legitimate but unsuckled* infants, no less than 69 per cent. died of diarrhœal and other diseases of nutrition, and of the *illegitimate* 68 per cent.; while of the legitimate *but suckled* infants only 45 per cent., and of the illegitimate *but suckled* 43 per cent. died of those diseases—a closeness of agreement, in the manner of their death, which warrants my assertion that the want of maternal nourishment and the greater general care and solicitude bestowed by a nursing mother upon her child, really places both the legitimate and the illegitimate infant upon the same platform, and that one which tends to death by diarrhœal and allied diseases.

On the other hand, I believe that a high *adult* diarrhœal death-

rate indicates most probably an impure water supply. My reasons for this belief are derived from the experience of Glasgow before and after the introduction of Loch Katrine water. We had in this alteration in one of the most important health-factors of a community, made at a precise time, one of those rare opportunities of observing an effect upon health under circumstances of almost experimental accuracy. The result was this—Taking three periods of time, the first under the old water supply, of six years, from 1855 to 1860, allowing the latter year for the effecting of the change; the second under the new, from 1861 to 1870; and the third from 1871 to 1876, for the sake of comparison. The diarrhœal death-rate at all ages fell from 136 to 81 per 100,000, and I may say the effect was immediate, even in the first year. But this improvement was confined to the population above five years of ago. There the death-rate fell at once from 62 to 28 in the first period, and still further to 24 in the most recent period; while, on the contrary, the infantile death-rate was 409 immediately before, 411 immediately after, and 463 in the most recent period. I fear we must look deeper than our water supply, or any other general physical condition, for the explanation of this rise in the diarrhœal death-rate among Glasgow children. It makes me doubt whether the children of the working classes have benefited by their prosperity, or whether they have not rather suffered by the consequent self-indulgence of their parents.

I have said enough to show that in the aggregate diarrhœa is not a cause of death which can be safely introduced in this portion of our present inquiry. Cholera, again, is in this country wholly an epidemic disease, dependent for introduction upon circumstances incident to traffic with infected ports, trade or immigration, water, &c., upon which I hope, during the currency of this session, the Secretary of the Sanitary Section, Dr. Christie, will contribute from the abundant stores of his personal knowledge. This being so, the insanitary conditions favourable to its spread may be equally present in two districts, and yet to the one the seeds of cholera may be brought and not to the other. On the other hand, enteric fever and diphtheria are endemic; their specific germs are very generally diffused, so that their activity is a very safe indication of the presence, and accurate measure of the *degree* of the presence of conditions favourable to their development.

We cannot in Scotland go far back with our statistics of death in the form of a national register, which is the only safe source of information. The Scotch Registration Act came into operation in

1855; but diphtheria was not distinguished as a cause of death by the Scotch Registrar-General until 1857.* Enteric fever was not distinguished from the general class "Fever" by the Scotch Registrar-General until 1865.† There are therefore no statistics available regarding those test diseases until those comparatively recent dates.

Before proceeding to deal with those statistics, I must make another preliminary remark in explanation of the definition of diphtheria and enteric fever. It has been customary to classify croup with diphtheria in our local statistics, the reason being that they are sometimes difficult to distinguish, and may therefore be occasionally confounded by mistakes in diagnosis. I am satisfied, however, after the close scrutiny of the circumstances surrounding those diseases, as classified from the registrar's books, necessitated by this inquiry, that they are distinguished with sufficient accuracy to give them in the mass a perfectly distinct character, and therefore a perfectly distinct sanitary meaning. Croup has all the features of the class of acute diseases of the respiratory organs. I hope to make this apparent to you later on, and therefore employ diphtheria alone for our present purpose. Then, as to enteric fever, I have added to the deaths specified by that name those classified as infantile fever. It is now universally admitted that the diseases are the same.

From the first publication of the vital statistics of Scotland, the Scotch Registrar-General has made a most useful and intelligent attempt to subdivide the country into statistical groups of districts which would illustrate "the influence of locality on the prevalence and fatality of different diseases." ‡

From 1855 to 1871 only three such groups were instituted. These were called the Insular, the Mainland-Rural, and the Town Districts. They are thus described in the Census Report for 1861, and it will be necessary for you to remember it, so as to understand the statistics to be brought before you. "The *Insular* group of *Districts* consists of Orkney, Shetland, and Bute, with the insular districts of Ross and Cromarty, Inverness and Argyle. The *Town Districts* embrace all the towns with populations above 10,000 inhabitants, as well as the suburban districts of Govan and Barony, and the Coatbridge district of Old Monkland; while the *Mainland-Rural Districts* consist of the remainder of the

* By the English in 1859. † By the English in 1869.

‡ First Annual Report, 1855, p. 11.

Mainland Districts of Scotland not included in the town districts."*

This arrangement was maintained until the census of 1871, when it was found that many of the towns had grown into a class by themselves, distinguished by their magnitude from the rest, while many villages had grown into towns, and so must be excluded from the mainland-rural districts. Accordingly the three groups were expanded into five, of which the following is the description, to which also your attention is required :—"Group I. *The principal towns* (eight in number), each containing at least 25,000 inhabitants; group II. *The large towns*, each containing not less than 10,000, nor more than 25,000 inhabitants; group III. *The small towns*, each with at least 2,000, and not more than 10,000 inhabitants; group IV. *The Mainland-Rural Districts*, from which are of course excluded all towns with 2,000 or more inhabitants; group V. *The Insular Districts*, which include the whole population of the islands on our coasts, but from which are of course excluded the inhabitants of the four small towns—Kirkwall, Lerwick, Stornoway, and Rothesay."†

Now let me direct your attention to the diagrams (Plates I.—III.), on which is depicted the history of diphtheria and enteric fever, so far as recorded in our national death-registers, year by year, in those subdivisions of Scotland. The town districts are *black*, and the other districts are indicated by difference of shading. The year is marked at the head of each group of columns, and the black bar drawn across each group shows the mean for all Scotland in each year. The height of each column represents the proportion of deaths per million of the population, as does the position of the black bar. It was necessary to adopt this unusual scale because all the death-rates with which we have to deal, if expressed in the usual way, per 1,000 of population, would be *less than one*, and the majority of the differences would be in the second decimal.

Look first at the diagram which represents the yearly death-rates from DIPHTHERIA (Plate I.) This is much more interesting and valuable than the corresponding diagram of enteric fever, inasmuch as it shows the whole history of that disease as an epidemic since its reappearance in this country. The Registrar-General tells us,—"Diphtheria first showed itself in an epidemic form in Scotland in

* Census Report, 1861, vol. ii., p. ix. For detailed list of districts in each group, see p. lxv.

† Report of Census, 1871, vol. i., p. xi.

1857, but only in a few isolated spots, having apparently no connection with each other, *and chiefly in sequestered rural situations, in some of which the sanitary condition was very bad.*" * Observe, then, *that it first attacked the rural districts, not the towns;* and we may add that this was not a feature peculiar to Scotland. In England, also, at the same time, it first appeared and first spread epidemically, not in the cities of England, but in the hamlets and country districts.

Observe, first, the position of the black horizontal bars, which show that from 1857 the epidemic rose gradually until it reached its acme in 1868, from which it fell slowly to a point of almost uniform prevalency in 1867 to 1870. Since then it has risen steadily until 1873, to fall again in 1874, when our information ceases.†

This is the progress of the wave over the country as a whole, but when we look to its distribution in the different districts of the country, we see that in the period 1857 to 1870, while the epidemic rise and fall is distinctly marked in the rural, mainland-rural, and town districts, the crest of the wave is highest in the mainland-rural, next highest in the insular, and lowest in the town districts, the respective highest death-rates being 720, 600, and 530 per million inhabitants. Not only so, but, taking each individual year, you will observe that in twelve the mainland-rural rises above the towns, in one they are equal, and in only one is the town group higher. In four years even the insular-rural columns overtop the towns. The right hand portion of the diagram with the re-arranged districts shows that the second epidemic rise affected all the districts, and that the acme was reached in 1872 by the principal towns, with 380 per million ; in 1873 by the small towns, with 420 per million ; in 1874 by the large towns, with 470 per million; the acme of the mainland-rural being the same as that of the eight principal towns—viz., 380 in 1874. The effect of removing the villages of from 2,000 to 10,000 inhabitants from the mainland-rural districts is nothing like so marked on the relative position of that group as we should expect, but the insular group is decidedly lowered by the exclusion of its populous places.

You will observe an arrow-head projecting from the black columns. This marks the position of Glasgow among the towns, and consequently has very special interest for us. The epidemic was longer in obtaining a hold upon Glasgow than upon the other towns

* Annual Report for 1858, p. 33.

† The facts for 1874 are not published, but have been kindly furnished in advance by the Registrar-General.

and districts, but it rapidly rose to an acme above the average of the other towns in 1863, when the death-rate was 600 per million, which is nearly double the highest figure ever attained since. In 1864, however, we see that even the rural districts reached 600, and the mainland-rural surpassed it with 720. This, I need not say, is a most remarkable fact. You will observe that in the most recent years, to the right of the diagram, the arrow-head which marks the position of our city is always considerably below the horizontal bar which marks the mean for the whole of Scotland.

Turn now to the diagram which depicts the history of Enteric Fever (Plate II.) It is very unfortunate that this history only dates from 1865, because enteric fever has been undoubtedly endemic in this country without interruption for generations. It is especially vexatious that the distinction between it and typhus was not adopted in the national registers of Scotland sooner, because it was first recognised and recorded by Glasgow physicians, following the physicians of the Continent. In 1836 Drs. Percy and Stewart demonstrated the points of difference in the wards of the Royal Infirmary, and since 1847 the two fevers have been entered in the books of that institution by their respective names.

The relative position of the horizontal bars showing the annual mean prevalence is typical of the endemic as their position in the diphtheria chart is typical of the epidemic character. There are fluctuations, but they are trifling, and on the whole there is a slight aggregate diminution in the more recent years. The columns, however, show distinct epidemic spurts or outbreaks, and that in the mainland-rural districts, and in the small towns. The actual highest points are in the mainland-rural and small town columns, 580 and 590 per million respectively, the highest town group being 540. In the left hand series of years the mainland-rural is considerably above the towns in two years, and in the remaining four there is but a slight difference in favour of the former. The right hand group, however, proves that the headquarters of enteric fever are in our small towns and villages, which tower above the towns in each year. There can be no doubt that it is this which explains the high level of the mainland-rural districts in the older subdivisions to the left.

The position of the arrow-head shows that Glasgow holds a high position among the local enteric death-rates. Still, in 1866, it will be noted that the rate was only 470 per million against the mainland-rural 580. The highest recorded rate in Glasgow up to last year was that shown in 1868—viz., 610.

I shall now ask you to turn your attention to another diagram of great importance and interest (Plate III.) It refers to diphtheria during the ten years between the census of 1861 and that of 1871, and derives a special value from three circumstances: (1.) That the population being determined from two points, one at the beginning, the other at the end of the period, it is strictly accurate; (2.) that every death-rate represents the mean of ten years; and (3.) that each county in Scotland is represented apart, with its own rural and town districts placed side by side. We are thus able to say, not merely how all the rural and all the town districts of Scotland taken together stand to each other, but to take the towns of every county and compare them with their surrounding rural districts, in respect of the fatality of diphtheria, and so at once eliminate all such causes as difference of soil, climate, &c. As in the other diagrams, the black represents the town districts. The counties which had no towns above 10,000 inhabitants in 1861 are massed to the right. The black horizontal band marks the mean of all the towns, which was 254 per million, the mainland-rural being 355, and the insular-rural 217. The columns representing the eight principal towns are indicated by the letters P.T.

With these explanations I might almost leave the diagram to tell its own remarkable story. There are eleven counties containing towns which are singled out from their surrounding country, and in only three is it not the case that these towns are freer from diphtheria than the country round about them. These three are Ayr, Lanark, and Edinburgh; but while the town of Ayr was slightly worse than the county, that of Kilmarnock was considerably better; while Coatbridge and the suburbs of Glasgow were worse than the county of Lanark, Glasgow proper, and the towns of Hamilton and Airdrie, were decidedly better; and although Edinburgh town is higher than Edinburgh county, Leith is a very little lower. Look, on the other hand, to the county of Aberdeen, where the town is 304, and the country 693 per million; the county of Forfar, with the town of Montrose at 143, and Dundee at 237, while the country is 496; the county of Perth, with the town at 182, and the country at 420; the town of Dumfries at 116, with its county at 253, and the suburb of Dumfries, Maxwelltown, at 41, lower than insular Orkney and Shetland, in fact, the lowest in Scotland, and yet the county in which it stands had a death-rate from diphtheria of 319, or nearly eight times as high. Turn now to the 21 rural counties to the right, and you will observe that 13 of them rise above the mean line of the town districts; and we have the

sparsely populated and distant Caithness towering above all with 591, not, however without a rival, which it finds, not in Glasgow, or Edinburgh, or any other town, but in the rural portion of Aberdeenshire, which you see rises like an Alp on the extreme left of the diagram. In the county of Caithness there are 56 persons to the square mile; in the county of Aberdeen (including its towns) there are 124; in the county of Lanark (including its towns) there are over 900; and in Glasgow we have to endeavour to live with 64,000 per mile, and yet the people poison each other with their infected excreta at more than twice the rate in Caithness, and more than 2½ times the rate in the country districts of Aberdeenshire that they do in Glasgow, and that not for one phenomenal year, but on the average of ten successive years.

I wish it had been possible for me to present to you a similar chart of the comparative fatality of enteric fever, but we must wait for the census of 1881 before the materials will be provided. Such data as exist are exhibited in these diagrams. They show that on a six years' average of the triple subdivision of Scotland the death-rates per million from enteric fever were—insular-rural 140, towns 480, and mainland-rural 485. On a four years' average of the more recent five subdivisions, the order is—insular-rural 200, mainland-rural 370, principal towns 430, large towns 460, small towns 550. These facts, as well as a considerable acquaintance with the current history of enteric fever, its degrees of endemic prevalence, and the distribution of its annual epidemic outbursts, lead me to anticipate that when the next census has been taken, and a ten years' chart can be formed, it will not be very different in its graphic representation of the neglected nastiness of our villages and country districts, and the comparatively favourable position of our cities, even under the fearful odds imposed by their size, their density, and the character of a large proportion of their population.

Here I may with advantage, in a few words, bring into prominence some of the chief circumstances which compose the odds to which allusion has just been made, as being against our cities in such a comparison with the country and villages. They merely require to be mentioned. There is first, and chiefly, the element of density or aggregation of human beings on a confined area, the presence of which constitutes the town, and the absence of which, or the opposite of which, constitutes the country. The diseases whose comparative prevalence we have been investigating survive the completion of their career in one individual by passing to another. If a thistle be surrounded by miles of dry bare rock

which it is impossible to fertilise, it may float off its seed for years, and yet at the end of its own life the thistle will be extinct in that region. But if you lay off ten square miles round this thistle, and at regular intervals form little patches of earth at the rate of 56 per square mile, the floating seeds will discover those patches of earth, and germinate and fructify; and if you lay off another area of ten miles round another thistle, and make 64,000 such patches per mile, the process of dissemination will progress *cæteris paribus* a thousand times more rapidly, and the chances of the spread of the thistle infection are more than proportionately improved. If we found that, notwithstanding the increased chance, this thistle did not spread more rapidly, nay, did not even spread with half the rapidity of the thistle whose chances were so much less, then we might make sure that the channels of conveyance of the seed to the soil, the atmospheric currents, or accidental transport by water, by birds, &c., were immensely less numerous and active. Now, for thistle say diphtheria, and for the two areas say the county of Caithness and the city of Glasgow, and you have a perfect representation of the comparative facilities afforded for the propagation, not only of this, but of every other zymotic disease after its kind and according to its special habits of development in rural districts and in towns. Everything is left to chance in the country. The bounty of nature there is such that no improvidence can entirely squander it, as the comparative freedom of the country from acute pulmonary diseases shows; but in towns it is not so. There life would be impossible on such terms; and, as it were under a penalty of death, the towns have by permanent expenditure on sanitary works, by current expenditure on general supervision and the prevention of infectious disease, so controlled the channels of conveyance of the seed to the soil, that in regard to diphtheria, enteric fever, and cholera, a citizen of Glasgow runs much less risk of dying of these diseases than an inhabitant of Caithness or Aberdeenshire, or almost any other rural district in Scotland you choose to name!

Nor are the infectious diseases of the country, in their unchecked luxuriance, a matter of indifference to towns. The daily supply even of one essential of our food – viz., milk, brings such a city as Glasgow into what, in the strictest etymological sense, is familiar intercourse with all the pastoral country in the south of Scotland. I can say of my own knowledge, from investigations into the enteric fever of the last four years in Glasgow, that when it has become locally epidemic in certain parts of the town, it has been derived from excremental pollution miles off, either demonstrably or with

strong probability. So it has been in Greenock, in Edinburgh, in Leeds, London, and many other towns. In other minor ways the country contributes such diseases to the town; but enough has been said to show that the town and its arrangements are credited or discredited with much enteric fever at any rate, with the genesis of which they have nothing more to do than with the thistle-down which is borne into its streets from the country meadows.

Last of all the odds against the town which I shall notice is this —that both diphtheria and enteric fever affect youth, and the town population is much richer in this element than that of the country. About 90 per cent. of those who suffer from enteric fever are under thirty years of age, while more than half of those who have diphtheria are under five years of age. I shall not trouble you with the figures, but it is a matter of fact that a constant tide of persons, aged between fifteen and thirty, flows from the rural districts and villages into the towns. This in turn maintains a high relative birth-rate in towns, so that you see the ultimate result is to expose a larger proportion of persons, specially susceptible of infection, out of a population which is itself larger in relation to the area upon which it lives, to those diseases in the town than in the country.

Notwithstanding all those disadvantages, I have tested the urban populations by the most severe test—viz., the death-rate per head of population, which makes no allowance for the very different general death-rate as compared with the country. If we could contrast the number of cases of actual disease in town and country, the comparison would be correct as a basis for the estimation of the relative activity of the causes of the disease. But we can deal only with deaths, and a case of disease is passed on into the category of death, not merely by phenomena essential to the disease, but by agents external to it, and acting upon all persons suffering from whatever disease, and, indeed, whether diseased or healthy, who live in the locality where the disease prevails. Now, the proclivity to death is, on the whole, much greater in the town than in the country, from the existence of causes which affect the population in the aggregate; so that 100 persons suffering from enteric fever may yield twelve to fifteen deaths in the town against eight to ten in the country; and we should wrongly estimate the relative activity of the causes of enteric fever, if we took it to be in the ratio of eight or ten to twelve or fifteen, the fact being that they were probably equally active in the two places. The easiest way to give some general expression to those local differences of general mortality is to give the proportion of the deaths

from the individual disease to the total deaths. In the ten years 1861-70, of the total deaths in the towns, 96 per 10,000 were caused by diphtheria, in the insular-rural 132, and in the mainland-rural 189. Then, as to enteric fever, on a six years' average of the three groups, it contributed 86 per 10,000 of the total deaths in the insular-rural, 170 in the towns, and 259 in the mainland-rural. On a three years' average of the five groups, the proportions were 121 per 10,000 in the insular-rural, 160 in the eight principal towns, 181 in the large towns, 213 in the mainland-rural, and 250 in the small towns.

Although the eight principal towns of Scotland—viz., Glasgow, Edinburgh, Dundee, Aberdeen, Greenock, Paisley, Leith, and Perth, as a whole, stand so favourably as regards those filth diseases, they present notable and marked differences one from another. I have made use of all available sources of information as to their individual internal condition, but a great deal of detail as to local circumstances, which it is difficult, if not impossible, to obtain or to estimate correctly without local inspection and personal observation, is evidently requisite to warrant trustworthy inferences. As I am anxious to follow up those diseases into their very habitats in Glasgow, the city with which we are all most minutely familiar, I shall merely run rapidly over the other towns, giving a few facts. The source of my information as to water-closets and water supply is the Rivers Pollution Commission's laborious Report on the Domestic Water-supply of Great Britain, where all the chief towns of the country may be referred to as in a dictionary, their names being arranged alphabetically. The facts in that report represent the state of matters in 1871. Their relative position as to death-rate from diphtheria and enteric fever is shown in another chart, and is determined from an average of the last eleven years. The following is the table on which the chart is founded:—

Death-rates per Million in Eight Large Towns, average of Eleven Years, 1866-76.

Diphtheria.		Enteric Fever.	
Perth,	180	Perth,	230
Paisley,	180	Leith,	350
Leith,	190	Dundee,	380
Aberdeen,	220	Edinburgh,	380
Glasgow,	230	Aberdeen,	450
Dundee,	290	Greenock,	470
Greenock,	310	Glasgow,	490
Edinburgh,	320	Paisley,	530

Perth stands lowest both in diphtheria and enteric fever, with death-rates of 180 and 230 per million. There was one water-closet to each 33 inhabitants in 1871, on which year I shall throughout base those ratios as the only available way of indicating a proportion by which the towns can be compared in this respect. The water supply is partly from the river, which is said to be pure, partly from another source, said to be impure, and in both cases is said to be defective in quantity.

Paisley has the same death-rate from diphtheria as Perth, but enteric fever is more fatal there than in any of the other towns, the rate being 530 per million. There was one water-closet to 96 inhabitants, and the water supply is good and abundant. Paisley is essentially a midden town. It has had good water since 1835, it is comparatively free of diphtheria, yet enteric fever is very prevalent.

Leith shares the Edinburgh water supply, which is intermittent and totally inadequate, and also in part impure. We have no information as to the number of water-closets, but *Edinburgh* had one to six of its population in 1871; and as part of the town is almost entirely without water-closets, and there are no middens, this high proportion arises from the number of large houses containing several such conveniences. Yet Leith has a diphtheria death-rate of only 190, while Edinburgh has the highest of all the towns, viz., 320; and Leith stands second lowest in enteric fever with 350, while Edinburgh follows with 380.

Aberdeen has a death-rate of 220 from diphtheria and 450 from enteric fever, the fourth and fifth lowest positions respectively. It had one water-closet to 44 inhabitants. The water supply is from the Dee, and is said to be pure and adequate; but in 1866 the point of intake from the Dee had been shifted higher up, so as to avoid certain sources of sewage contamination.

Glasgow stands fifth lowest in diphtheria, 230, and is second from the highest, *i. e.*, next to Paisley, in enteric fever—490.

Dundee follows as to diphtheria, 290, and is third lowest in enteric fever, 380, the same as Edinburgh. Yet the water supply is said to have been "far from good" and "quite inadequate," and it is called a water-closet town. I learn that since 1875 the water supply has been made copious and good.

Greenock is all but as bad as Edinburgh as to diphtheria, 310 per million, and comes just below Glasgow in enteric fever with 470 It was said to have one water-closet to 17 of its population, and the water supply has been good and abundant since so far back as 1773.

These average death-rates do not show the highest or epidemic points, and in this respect Glasgow stands most favourably, there being only one town which shows a lower acme in diphtheria and one in enteric fever. Paisley seems to have but trifling epidemic exacerbations of diphtheria, while enteric fever is a constant scourge; and Perth suffers much and increasingly from diphtheria, while enteric fever at its worst does not touch the Glasgow rate. There has been a decidedly decreased mortality from these diseases within the last few years in Glasgow, Edinburgh, Dundee, and Aberdeen.

It must be apparent from this rapid survey of our towns that more intimate knowledge is wanted of their inner condition to enable us to draw correct conclusions from such widely divergent mortalities. We shall now turn to Edinburgh and Glasgow, and endeavour to get a little nearer the heart of this sewage question, as it presents itself to us in towns regarding which we have more intimate knowledge, in relation to health.

While it may be correct, speaking generally, to call one town a privy town or a midden town, and another a water-closet town, we require more precision. We wish some information as to the privy or midden and water-closet districts of the town, which, being in one area, are supplied with the same water, subject to the same climate, and stand on the same soil; so that we shall have less difficulty in distinguishing any influence which the circumstances in which they differ may exercise. It is remarkable, however, how little precise information as to the statistical facts worth knowing we can obtain. In Manchester, for example, we find arguments in favour of their midden system, based upon statistics of the diminution of "fever" of late years. Yet the only "fever" which is directly related to questions of filth removal—viz., enteric, is thrown into one indiscriminate class, and diphtheria is not referred to at all. So it is in Liverpool, and indeed the national statistics of the English Registrar-General are also defective.

In 1874, the Town Council of Edinburgh issued a return, the value as well as the precise contents of which will best be shown by quoting its title, which is—"Return by the Burgh Engineer of the number of dwelling-houses, within each of the nineteen sanitary districts into which the city is divided, provided with water-closet accommodation, the means adopted for ventilating the same, and water supply, &c., with supplementary return by the Medical Officer of Health of the rate and amount of mortality and causes of death in each district." The facts as to mortality only extend to one year, 1871, and unfortunately the deaths from enteric fever are not

isolated from the general mass of "fever." I can therefore use only one test disease—viz., diphtheria, which it so happens was more prevalent in 1871 than it had ever been before or has ever been since in Edinburgh. By throwing the nineteen districts into four groups, I obtain the following comparison of the fatality of diphtheria, relative to the proportion of houses having water-closets inside their walls, and having no water-closet either inside or outside.

In Group I., 70½ per cent. of the houses had no water-closet accommodation whatever, and 9½ per cent had inside water-closets. The general death-rate was 32 per 1,000, the death-rate from diphtheria was 67 per 100,000, and the proportion to 10,000 deaths from all causes was 21.

In Group II., 36½ per cent. of the houses had no water-closet accommodation whatever, and 37 per cent. had inside water-closets. The general death-rate was 27 per 1,000, the death-rate from diphtheria was 62 per 100,000, and the proportion to 10,000 deaths from all causes was 23.

In Group III., 17 per cent. of the houses had no water-closet accommodation whatever, and 73 per cent. had inside water-closets. The general death-rate was 21 per 1,000, the death-rate from diphtheria was 79 per 100,000, and the proportion to 10,000 deaths from all causes was 38.

In Group IV., only 7½ per cent. of the houses were entirely without water-closet accommodation, while 88 per cent. had inside water-closets. The general death-rate was 20 per 1,000, the death-rate from diphtheria was 77 per 100,000, and the proportion to 10,000 deaths from all causes was 39.

It is scarcely possible for you to gather the precise meaning of those figures from simply hearing them read, but this is of less importance, as they serve rather to give a clue to the correct line of inquiry than fully to answer it; and I shall immediately proceed to lay before you, by the aid of diagrams, the result of a more perfect examination of further and more satisfactory statistics derived from our own city. The fact which I wish you to remember, and which those figures prove, is that a relation exists between the proportion of houses having inside water-closets, and consequently a connection between the sewers and their internal atmosphere, and the death-rate from diphtheria. It is 10 per 100,000 higher where 88 per cent. of the houses stand in this relation to the sewers than where only 9½ per cent. are so related; and the proportion of deaths from diphtheria is 18 per 10,000 higher. Still, there is an enormous

difference between the ratio of increase of inside water-closets and of the mortality from diphtheria. Although the maximum of internal water-closet accommodation is ten times the minimum, the increase of diphtheria death-rate is only a sixth, and we find the maximum death-rate of the four groups where the increase of internal water-closets is only about eight times the minimum proportion. But measuring the increase of diphtheria as a proportion of the total deaths, it rises with the proportion of internal water-closets, though still not at all in the same ratio.

Let us now endeavour, from the data supplied by our Glasgow experience, to push home this inquiry into the relation between internal communication between the atmosphere of our houses and the sewers, and those two diseases. In 1872, with that instinct for the vital points of contact between the sewage question and our health which has made your President remarkable among practical sanitarians, Dr. Fergus moved for and obtained a return from the Board of Police of "the number of houses, manufactories, and workshops in each street, and the drains, water-closets, &c., in communication with main sewers," with sundry details as to the condition of the sewer connections as to ventilation, relation to cisterns for domestic water supply, &c. Unfortunately this return was not, as in the case of Edinburgh, drawn up in relation to our sanitary subdivisions of the city, so that it is impossible to apply the valuable local information which it contains to those subdivisions.

Many of you must be familiar with the four groups of the sanitary subdivisions of Glasgow from the description which accompanies each quarterly issue of the Mortality Tables. The first may be called the water-closet group, only 11 per cent. of the houses being one apartment, and the density 70 per acre; while the fourth may be called the midden group, 44 per cent. of the houses being one apartment, and the density 320 per acre. In the former the death-rate per 100,000 from diphtheria, on the average of three years (1873-5), was 25, and from enteric fever 34; while in the latter the death-rates were 18 and 41. But the maximum death-rate from enteric fever was in Group II., where it was 50 per 100,000, that being the region of newly-built houses of small size, largely provided with modern conveniences. Although the absolute death-rate from enteric fever was higher in the so-called midden district than in the typical water-closet district, the proportion to the total number of deaths from this disease was decidedly the lowest. As we saw in the case of Edinburgh, measured in this way, the gradation was steadily downward in the proportion of deaths from

diphtheria as the presumable proportion of water-closets diminished, though not in the same ratio; but even in this aspect, Group II. had a pre-eminence over the water-closet district, in which the houses are of larger size. There is found both the highest enteric death-rate and the largest proportion to the total deaths. We have thus in both Edinburgh and Glasgow had our attention directed to an apparent relation between the death-rate from specific filth-diseases and the proportion of inhabited houses which are connected with the sewers. Let us now endeavour to work out this relation to a somewhat more precise issue.

There is no difficulty in expressing the problem in exact terms. The difficulty is to obtain the requisite data wherewith to solve it. Hitherto we have been dealing with averages and proportions, and otherwise, as it were, endeavouring indirectly to work round the question, and consequently the answer we have obtained has been more a hint or suggestion than an answer. It is evidently not enough to know only that a certain percentage of the total houses in a district have water-closets inside their walls, and that a certain death-rate of all the inhabitants of these houses was ascertained to have been caused by a certain disease. We wish to know also whether those persons died in these houses, and if not all, what comparative proportion died in these houses, and in others in the district not provided with water-closets, per head of their respective populations.

It is evident that this detailed information is to be obtained in two directions—(1.) from inquiries made as to the surrounding circumstances of those who die; (2.) from a minute census of the circumstances of those who are alive, *i.e.*, of the general population. As the whole fabric of our conclusions rests upon the correctness with which these facts have been collected, it becomes necessary not only to give you the facts, but to indicate the precautions adopted to ensure their completeness.

First, then, as to the deaths. Since the middle of 1873, every death occurring in the city from any zymotic disease, or from diseases of the lungs, has been written upon a card, on which is printed a blank form, which is filled up with the required particulars from information obtained in the house where the death occurred. In this way a mass of important information is collected, a small portion of which I intend now to make use of. It includes minute details about the size of the house, the position of the water-closet, if there be one, and also of the sawbox or sink. The diseases which I have investigated in connection with the present inquiry

include, of course, diphtheria and enteric fever, but in addition croup, in order to show how it differs from diphtheria and diarrhœal deaths, because of their frequent association with the specific filth diseases in a common origin. The number of deaths from diphtheria dealt with in the following statements is 420, from enteric fever 833, and from croup 556, being all that occurred in Glasgow from 1st July, 1873, to 31st December, 1876, or three and a half years. The number of deaths from diarrhœa is 965, being all that occurred in the years 1875 and 1876.

The first thing to be done was to choose a basis of classification. It seemed to me that whatever influence our sewers have in conveying impurities to our bodies must be exercised mainly, if not solely, through the communications which enter *within* the houses which we inhabit. These must, at all events, afford such a facility for the process of fertilising us with the germs of the specific diseases, which are supposed to emerge from the sewers, that if there be such a process, then there ought to be a distinct relation between the proportion of persons fertilised, out of the total number exposed, and the number of those possible channels of infection within the houses which these persons inhabit. It was necessary to take account, not only of water-closets, but of sinks, when situated within the house, both because these may bring in fæcal emanations, and because I believe that, in the smaller houses, where there are no water-closets, they also convey out matters which usually find an exit through a water-closet.

This being the basis, the following is the classification adopted. It is fourfold:—(1.) The deaths which occurred in houses having a water-closet *inside*, with or without a sink. (2.) Those which occurred in houses having a sink inside, but no water-closet. (3.) Those which occurred in houses having no connection whatever between their internal atmosphere and the sewers—*i.e.*, having

Sewer Connection.	Diphtheria.	Enteric Fever.	Croup.	Diarrhœa.	Percentages.			
					Diph.	Ent.	Cr'p.	Diar.
Water-closet, . .	160	235	84	152	38	28	15	16
Sink only, . . .	181	373	270	460	43	45	48	48
None, ...	69	173	187	304	17	21	34	31
Unknown, . . .	10	52	15	49	62		3	5
Total, ...	420	833	556	965				

neither water-closet nor sink. (4.) Those deaths concerning which, from the addresses not being found, or other causes, the information was not obtained.

Having got the deaths so classified, the result is found to be that 38 and 28 per cent. of the deaths from diphtheria and enteric fever occurred in houses in which there were water-closets, and 15 and 16 per cent. of these from croup and diarrhœa.

That 43 and 45 per cent. of the deaths from diphtheria and enteric fever occurred in houses having a sink but no water-closet, and 48 per cent. in each case of these from croup and diarrhœa.

That 17 and 21 per cent. of the deaths from diphtheria and enteric fever occurred in houses having no internal connection with the sewers whatever, and 34 and 31 per cent. of these from croup and diarrhœa.

So far so good, but it is evident that an important element in determining the influence upon health of an inside sewer connection is the size of the house—important in three ways—(1.) by relation to the degree of dilution of the fertilising emanations; (2.) by so far determining the number of persons exposed to these fertilising emanations; and (3.) by some degree of connection with the social position and habits of those persons. Therefore, the next step in the analysis was to subdivide each class in each disease, according as the deaths took place in houses of one, two, three, four, five, or more apartments.

I shall not trouble you with the actual figures obtained by this subdivision, but asking you to take for granted that it was carefully and correctly made, shall proceed shortly to state the information required to give precision to the interpretation of these figures, by enabling us to estimate the total number living under the varied circumstances in which the already ascertained number died. This information included three distinct facts—viz., (1.) the total number of inhabited houses of each size; (2.) the total number of the inhabited houses of each size which have water-closets inside, which have sinks only, and which have neither; (3.) the total number of persons inhabiting houses of each size and having such important differences in their internal relation to the sewers. This is the most essential item of information, because without it we should fall into an obvious fallacy in comparing houses as to the prevalence of disease in their inhabitants. A house and its arrangements express their influence upon health through the inmates, and a house of many apartments, containing many people, has a proportionately greater chance or possibility of showing its insalubrity than a house of few

apartments containing few people. It is so necessary that you should be convinced of the correctness of these facts, that I shall trouble you with a short explanation of the method by which they have been ascertained.

1. The total number of inhabited houses of each size is readily and correctly obtained from the City Assessor's annual assessment roll; a statement compiled from which is furnished each year to the Sanitary department, for the purpose of calculating therefrom the population of the city.

2. The total number of inhabited houses of each size which have water-closets or sinks inside can be determined only for houses of one and two apartments, for this reason, that in Dr. Fergus's return, already referred to, we find the number given, as in 1872, for those sizes of houses alone. All above that size are combined, and obviously no information can be got as to the proportion of houses having such arrangements, where the houses are of such a size as possibly, and indeed, in many cases certainly, to have several water-closets or sinks in each. But applying the percentage of houses of one and two apartments having, or not having, those conveniences in 1872 to the average of those inhabited in 1873-4-5 and 6, we get results applicable to the statistics of death before us.

3. The total number of persons inhabiting houses of each size I have estimated from certain useful returns of the Registrar-General, based on the Census of 1871.* From these sources I calculate that in Glasgow the average number of inmates of houses of various sizes is as follows :—

1 Apt., 3·29 persons.	3 Apts., 5·27 persons.
2 „ 4·97 „	4 „ 6·79 „

5 Apts. and above, 10·75 persons.

The accuracy of these estimates is confirmed by observation, but especially by this, that by applying them to the various sizes of houses inhabited in any one year, we get the exact population of that year.

The result of all these calculations is before me in a tabular form, and before you in the left-hand portion of the diagram, headed Death-rate per Million in Houses of various sizes in Glasgow according to size of houses, and according to Sewer-connections in small houses (Plate IV.)

* *Census Report*, vol. i., p. xxxvii, and p. 275.

Size of House.	Death Rate per Million.			
	Diphtheria.	Enteric Fever.	Diarrhœa.	Croup.
1 Apartment, ...	163	390	1446	421
2 ,, ...	250	459	919	344
3 ,, ...	292	574	548	183
4 ,, ...	277	374	304	142
5 ,, ...	126	186	307	91

The left half of the diagram shows the death-rates in houses of one, two, three, four, and five or more apartments, following in succession for each disease from left to right. Your eye will tell you that the death-rates from diphtheria and enteric fever increase steadily from one apartment up to three apartments, where they culminate in both diseases, to find in both their lowest level in the largest size of house. On the other hand, the death-rates from diarrhœa and croup are at their maximum in houses of one apartment, and descend, in steady gradations, to a minimum in houses of the largest size. Now, in all the vertical sections of this part of the diagram, and in each column of the table, we are dealing with the same people living in the same houses, yet while diphtheria and enteric fever agree in their mode of incidence upon those people, diarrhœa and croup manifest quite a different law ; consequently there must be some property or peculiarity about those houses which produces a different affinity for, or proclivity to, those diseases. It is as when a piece of calico, having a pattern described upon it with mordant, is dipped into a dye, and when it is washed, the dye is fixed in the parts which are prepared, but disappears from those which are not. What is the mordant which fixes the diphtheria and enteric fever upon the inhabitants of the houses of two and three apartments?

We learn from Dr. Fergus's return that $1\frac{1}{3}$ per cent. of the houses of one apartment in the city actually had a water-closet inside of them, and that about 32 per cent. more had sinks. We learn also that 13 per cent. of the two apartment houses had inside water-closets, and 56 per cent. more had sinks. Therefore, in one way or another, the internal atmosphere of fully 33 per cent. of the one apartment, and 69 per cent. of the two apartment houses was in communication with the drains. The question then is, does it make any difference to the inhabitants of a one or two apartment house that there is or is not a communication between the house air and the sewers?

Are they, or are they not, more liable to be fertilised with the germs of those diseases?

You will find the answer in the right hand portion of the diagram, in which the numerical statements contained in a table before me are depicted. The size of house is marked under each vertical subdivision by numerals, and above each numeral are three columns, whose height indicates the comparative death-rate in houses of that size, according to their sewer connection, which is shown by words at the top of each column. As only one death from enteric fever, one from croup, and none from diphtheria were recorded in a house of one apartment having a water-closet, that column is merely dotted in for uniformity under those diseases, and there are blanks in the table.

Sewer Connections.	Diphtheria.		Enteric Fever.		Diarrhœa.		Croup.	
	1 Apt.	2 Apt.	1 Apt.	2 Apt.	1 Apt.	2 Apt.	1 Apt.	2 Apt.
Water-closets, .	—	418	—	665	1,978	667	—	294
Sink, . . .	253	275	677	465	2,194	998	633	338
None, . . .	120	127	249	386	1,072	880	324	366

Your eye will again tell you that the death-rates of diphtheria and enteric fever are both at their minimum in houses of one and of two apartments, which have no communication with the sewers; and at their maximum in those one apartment houses which have sinks, and in those two apartment houses which have water-closets—that is to say, if you have a house of one apartment with no direct means of access for the specific germs, you may yet have 120 deaths per million from diphtheria, and 249 from enteric fever; if you introduce a sink, you may have a death-rate of 253 from diphtheria and 677 from enteric fever. So, if you have a house of two apartments, with no direct means of access for the specific germs, you may still have a death-rate of 127 per million from diphtheria, and 386 from enteric fever; if you introduce a sink, you may have a death-rate of 275 from diphtheria, and 465 from enteric fever; and if to the luxury of a sink you add that of a water-closet inside such a house, you may have a death-rate of 418 from diphtheria, and 665 from enteric fever.

Now, these facts not only prove, without, so far as I can see, the shadow of a doubt, that the inhabitants of one and two apartment houses run a risk of impregnation with these specific germs, which

is increased as you introduce sinks and water-closets within their houses, but they also prove these conveniences to be factors of those diseases wherever they are found, *unless controlled and limited in their action by overruling or modifying circumstances.* If you go back to the left hand part of this diagram, you observe that the culminating point of the mortality of these two diseases is in houses of three apartments. Unfortunately, for reasons already stated, I cannot tell you the proportion of these houses which have or have not water-closets or sinks, but if we know that when we pass from the class of one apartments to that of two apartments, we rise from 33 per cent. to 69 per cent. of internal sewer-connections, we may be quite certain that three and four apartment houses have every one a sink, and nearly every one a water-closet inside, while houses of five or more apartments are all so provided—the larger, indeed, having several. What is it, then, that controls those factors of specific disease, so that in fact the mortality from both is *lower in houses of the largest size with all these conveniences, than in houses of the smallest size which are entirely without them?*

Here we may take up those parts of the tables and diagram which refer to diarrhœa and croup (Plate IV, right hand portion). The mortality from these diseases culminates among those who inhabit one apartment houses, and declines without a break to its minimum in the largest houses; and when we compare the mortality in the smaller houses in relation to their sewer-connections, we do not find that agreement or consentaneous movement which indicates the casual relationship. In the diarrhœal columns for one apartment that representing the death-rate in houses having a sink is highest, the water-closet column is next, and the column for houses having no sewer-connection is nearly one-half lower than either. On the other hand, you observe that in two apartment houses, while the diarrhœal death-rate is highest in those having "sinks," it is one-third lower in those having water-closets, and only one-ninth lower in those having no sewer-connection whatever. As to croup, although the death-rate is highest in one apartment houses which are provided with "sinks" inside, the three classes of two apartment houses follow the very reverse order to that which we observe in diphtheria and enteric fever—viz., from a minimum in those with water-closets to a maximum in those having neither water-closet nor "sinks."

Now, I take it that we have, both in the descent from the culminating point at three apartments in the mortality from diphtheria and enteric fever, and in the continuous descent in the mortality of

diarrhœa and croup, as you proceed from the smallest to the largest size of house, the predominance of a great general law of mortality in regard to the house accommodation of the people. I believe that if you were to classify the whole population of the city according as they occupied houses of one, two, three, four, five, or more apartments, and then to ascertain the aggregate death-rate from all causes in each class, you would find that it followed exactly the order of the diarrhœa and croup columns in the left hand part of the diagram. It would have its maximum in the population living in one apartment houses, and fall in gradations to a minimum among those who inhabited the largest houses. The rental, and consequently the size and comfort of a man's house, bears in the aggregate a constant relation to his general well-being. The small house means straitness of circumstance from whatever cause, and brings with it a constant tendency to overcrowding with its morbific influences, especially in the production of pulmonary diseases, the aggravation of the infectious diseases, especially of childhood, and that general deterioration of the moral tone and social virtues which tells with fatal effect upon those who depend upon those virtues most for the tenure of their frail lives—the infants. While, therefore, I believe that in reference to the excess of diarrhœal deaths among those who inhabit one and two apartment houses provided with sinks, there may be a slight evidence of a deleterious influence emanating from those sinks, and producing infantile diarrhœa, and also that a proportion of the disease associated with sinks in one apartment houses, and called croup, may be in reality diphtheria, still those two diseases manifest much more decidedly that influence of selection which the size and quality of the house exercises in aggregating the population into groups, over whose general mortality the law presides, of increase *pari passu* with the decrease of the rental and consequent accommodation and sanitary and social advantages.*

* An attempt has been made to establish a relation between this fact of general "well-being" and mortality, by comparing income and death-rate. Virchow touches on the subject in his report, "Reinigung und Entwässerung Berlins," p. 75; but the following is a better example of the result, derived from a classification of the inhabitants of Barmen, as given by Dr. Sander, in his "Handbuch der öffentlichen Gesundheitspflege," p. 106.

Income.	Population.	Average death-rate—5 years (1870-74).
0—£30	54,559	34½
£30—£75	8,421	19
£75—£150	2,612	18
above £150	1,693	16½

It is the absence of the sewer-connection by sink and water-closet with the internal atmosphere of a large proportion of the one and two apartment houses which removes their inhabitants from the action of this law, so far as diphtheria and enteric fever are concerned. If every house of each size were connected alike with the drains and sewers, then I am sure the diseases specially associated with such misplaced connections would conform to the general law, and be at their maximum in the smallest houses. On the other hand, and this is the practical issue of these facts, I am also convinced that if we banish water-closets from the inside of our small-sized houses; if we make their sinks discharge in the open air over a gulley in the court; if we thoroughly revise at sight of competent public officers all water-closets and sewer-connections in our large houses and on common stairs, or wherever found; if we ventilate our sewers and house drains on the separate system, and entirely give up using cistern water for dietetic purposes, we shall reduce our mortality from diphtheria and enteric fever to the lowest possible minimum. Even with all the outrageous blunders of position and construction in our largest and best houses, and without that official inspection of new buildings in regard to details of sanitary arrangement which ought to be instituted, you have seen that in these houses, in the four years, 1873-76, the mortality from diphtheria was only 126 per million, and from enteric fever 186, rates which are far below those which constantly prevail in the majority of purely country districts, as depicted on those diagrams, and also much below the mortality from enteric fever in small houses which have no sewer connections whatever. But how do those diseases occur in houses with no sewer connection? If we find that 17 per cent. of all the cases of diphtheria, and 21 per cent. of all the cases of enteric fever arise in houses which are destitute of those channels of access, which are so freely blamed with *all* that happens inside houses which have those channels of access, then it is clearly illogical to continue so to blame them. We must look elsewhere for the cause, to importation by contaminated food, possibly to ill conditioned ash-pits, and while putting themselves in order, our cities

There is therefore a falling death-rate with a rising income, but manifestly the income does not cover all the elements which regulate the death-rate, and I fancy the house-rent would develop a much more intimate relation. It is that portion of income devoted to supplying the prime necessary of life—a house to live in. Therefore it gives expression to those vices which divert income from its legitimate uses, as well as to those virtues which have the opposite tendency.

must push for an improvement in the local sanitary organisation of the country, which will relieve them of a constant source of danger. The power which shall move the dry bones of rural sanitary authorities must come from within the towns; and I would recommend the subject to the attention of our City Members as one which is, without doubt, "within the sphere of practical politics."